ENGINEERING REPORT

MYSTIC RIVER BRIDGE

Oct. 24, 1958

Submitted to

MYSTIC RIVER BRIDGE AUTHORITY

J. E. GREINER COMPANY

Consulting Engineers

August 1947

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CHARLES A. MAGUIRE AND ASSOCIATES
ENGINEERS
46 CORNHILL
BOSTON 8, MASS.

May 3, 1948

Mr. Thomas E. McCormick
City Planning Department
43 City Hall
Boston 8, Massachusetts

Dear Sir:

In response to your request of April 30, we are delivering to you herewith a copy of the Engineering Report which we prepared for the Mystic River Bridge Authority in August of last year. In the back of this Report you will find a plan showing the approaches in Charlestown which is the area in which we assume you are particularly interested.

We wish to call to your attention, however, the fact that these approaches in Charlestown are still the subject of study and will unquestionably be drastically revised before the final plans are determined. These changes refer both to approaches in the area near Park Street and also in the vicinity of the U. S. Naval Shipyard at Wapping and Water Streets.

We shall be glad to keep you informed of further developments.

Very truly yours,

Charles A. Maguire & Associates

Clyde C. Mackenzie

CCM:nbc
Enclosure

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MYSTIC RIVER BRIDGE AUTHORITY

BOSTON, MASSACHUSETTS

EPHRAIM A. BREST, Chairman
EARLE R. BARNARD, Vice Chairman
JOHN F. DONOVAN
FRANK RAMACORTI

W. H. BURACKER, Commissioner
State Department of Public Works

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J. E. GREINER COMPANY
CONSULTING ENGINEERS
1201 ST. PAUL STREET
BALTIMORE, 2 MD.

August 8, 1947

Mystic River Bridge Authority
Boston
Massachusetts

Gentlemen:

In accordance with our agreement, dated December 31, 1946, we have made an engineering study of a bridge to connect Charlestown and Chelsea at the approximate location of the existing Mystic River Bridge between those two points. We have considered the location and type of facility and the immediate approaches thereto, prepared preliminary designs and estimates of cost of construction, maintenance and operation, and studied the financial aspects of the undertaking. Our report, describing in detail the various phases of the project and stating our findings in connection therewith, is submitted for your consideration.

We have concluded that the project, as described in the report, will adequately serve the demands of traffic between the communities of Charlestown and Chelsea and that the project can be feasibly operated as a self-liquidating undertaking.

We recommend that the Authority, following its consideration of this and other pertinent reports, proceed with the necessary negotiations for financing and constructing the facility.

In the preparation of this report, we have been assisted by Charles A. Maguire and Associates, Consulting Engineers of Boston, Massachusetts, and Providence, Rhode Island.

Very truly yours,

J. E. GREINER COMPANY

by H. H. Allen

H. H. Allen

HHA:HGM
Enclosure

PROPOSED BRIDGE

OVER

THE MYSTIC RIVER

BETWEEN

CHARLESTOWN AND CHELSEA

ACKNOWLEDGEMENTS

For helpful assistance in many matters connected with the development of this report, J. E. Greiner Company gratefully acknowledges the cooperation of:

The Mystic River Bridge Authority

The Department of Public Works of the Commonwealth of Massachusetts

Commandant, First Naval District, Boston, Massachusetts

U. S. District Engineer, Boston, Massachusetts

The Metropolitan District Commission

Municipal Departments of the City of Boston

Municipal Departments of the City of Chelsea

Port of Boston Authority

Massachusetts Federation of Taxpayers Associations, Inc.

Boston and Maine Railroad Company

United States Gypsum Company

Boston Elevated Railway Company

Boston Consolidated Gas Company

New England Telephone and Telegraph Company

Boston Edison Company

HISTORICAL

The first need for transportation facilities across the Mystic River was felt in the early part of the 17th century. Historical records describe the operation, beginning in June, 1631, of the first ferry in New England, probably the first in North America, crossing the Mystic River between the town of Winnisimmet and the towns of Charlestown and Boston.

In the year 1802 legislative authority was granted the Salem Turnpike and Chelsea Bridge Corporation to construct, maintain and operate a toll bridge between Chelsea and Charlestown. Under the authority granted by the charter, a timber structure, called the "Chelsea Bridge," was constructed. The bridge provided a 32-foot roadway which was narrowed down to 16 feet at the draw spans across the North and South channels. Each draw span provided a 30-foot clear waterway.

The draw span over the North channel was rebuilt in 1873 to a length of 110 feet and a 36-foot roadway width.

In 1880 the draw span near Charlestown was designated the "Chelsea South Bridge" and the draw span near Chelsea was designated the "Chelsea North Bridge."

During the years 1893 to 1895 the roadway of the Chelsea North Bridge was widened to 50 feet.

As a result of a War Department order in 1910 requiring increased channel clearances at the Chelsea North Bridge, the existing four-lane structure with a swing span providing two 125-foot clear waterways was constructed.

HISTORICAL

In 1933 a Special Commission was established to investigate a proposal to reconstruct the Chelsea North Bridge. The Commission consisted of the State Commissioner of Public Works, two associate Commissioners, and the City Engineers of Boston, Chelsea and Revere. The findings resulting from the investigations favored the construction of a high level bridge, but economic conditions at that time dictated a recommendation to repair the existing bridge for continued use until such time that funds should become available to construct a high level crossing.

The Division of Metropolitan Planning conducted a study in 1941 and recommended a high level bridge as the solution to the problem. There was no legislative action on this report.

Several subsequent proposals were made and referred to the Post War Highway Commission and the Legislative Committee on Highways and Motor Vehicles, for study and recommendation. The construction of a high level bridge as a self-liquidating facility was the recommendation resulting from these studies. As a consequence, enabling legislation was drawn and passed as House 1979, dated May 23, 1946, which was entitled "AN ACT PROVIDING FOR THE CONSTRUCTION, MAINTENANCE, REPAIR AND OPERATION OF A HIGH LEVEL TOLL BRIDGE BETWEEN THE CITIES OF BOSTON AND CHELSEA OVER THE MYSTIC RIVER AND THE TRACKS OF THE BOSTON AND MAINE RAILROAD, PROVIDING FOR THE CREATION OF THE MYSTIC RIVER BRIDGE AUTHORITY AND DEFINING ITS POWERS AND DUTIES AND PROVIDING FOR THE FINANCING OF SAID PROJECT."

HISTORICAL

Pursuant to the provisions of the Act, the Mystic River Bridge Authority was formed with the following members serving:

Mr. Ephraim A. Brest	Chairman
Col. Earle R. Barnard	Vice Chairman
Mr. John F. Donovan	Treasurer
Mr. Frank Ramacorti	Secretary
Mr. Joseph Cairnes	Commissioner of the State Department of Public Works

Mr. Cairneswas later succeeded by Captain W. H. Buracker, the newly appointed Commissioner of the State Department of Public Works.

Following organization procedure and due discussion of the engineering, legal and financial aspects of the project, the Authority, under the powers granted it by the Act, retained the services of DeLeuw, Cather and Company to prepare a traffic report. J. E. Greiner Company, with Charles A. Maguire and Associates as Associate Engineers, was then retained to prepare an engineering report, design, plans, specifications, and to supervise the construction of the project.

A banking group comprised of The First Boston Corporation, F. S. Moseley and Company, and Tripp and Company, Incorporated, was selected to administer and market the revenue bond issue. The banking group retained the firm of Mitchell and Pershing as revenue bond attorneys.

The First National Bank of Boston was selected to act as Trustee.

EXISTING STRUCTURES

The Chelsea North Bridge is 1,163 feet in length between pierhead lines and consists of a swing span over the main channel, flanked by two trestle approaches supported on timber piling. The draw span has an overall length of 360 feet and a roadway width of 40 feet between curbs with two 8-foot sidewalks cantilevered outside of the trusses. The two approach trestles provide a 44-foot roadway with an 8-foot sidewalk on the south side of the bridge.

The bridge accommodates four lanes of traffic; however, vehicular movements are restricted somewhat in passing over the draw span. This condition is particularly aggravated during the winter months when the open traffic lanes are further restricted by the piling of snow adjacent to the curbs.

During the years 1926 to 1945 the cost of maintaining and operating the Chelsea North Bridge amounted to $977,546.00. Of this amount $506,074.00 was expended for repairs and $471,472.00 covered wages, operating materials and supplies for the twenty-year period. The structure received major repairs in 1935 at a cost of $265,000.00.

The Chelsea South Bridge, 360 feet in length, consists of a double leaf bascule span providing a clear channel width of 75 feet and two steel girder approach spans. The structure carries two 20-foot roadways and two 7'-6" sidewalks. Over the bascule span the roadways are separated by a medial divider 5'-6" in width. The bridge comes to grade on the Charlestown end near Medford Street via a ramp approximately 500 feet in length.

EXISTING STRUCTURES

The area lying between the Chelsea North and the Chelsea South Bridges is occupied by the yards and docks of the Boston and Maine Railroad. The two bridges are connected by a timber and steel trestle viaduct 1,360 feet in length. The viaduct carries a 45-foot roadway and is connected to the railroad facilities via a ramp.

The existing bridges serve traffic between the thickly populated north shore area of metropolitan Boston and the central business section of the city. The facility also provides direct access to the Charlestown and western section of the Boston metropolitan area and is considered one of the major transportation links in the arterial highway system of the area.

Frequent openings of the draw span over the Mystic River channel result in considerable highway traffic delay and severe traffic congestion. Observations made at the site during several openings of the bridge disclosed that traffic is often backed up for several blocks north of Winnisimmet Square in Chelsea and as far back as City Square in Charlestown. At such times not only is the free flow of bridge traffic disrupted but congestion is also created on the city thoroughfares adjacent to the termini of the structure.

The Chelsea North Bridge will be replaced by the proposed high level crossing; however, the Chelsea South Bridge must remain in operation to provide access for local traffic to the industrial facilities located in the yards and marine terminals of the Boston and Maine Railroad.

DESCRIPTION OF THE BRIDGE

The Mystic River Bridge is a high level double deck structure providing for three lanes of vehicular traffic in each direction. It consists of a long span cantilever unit over the main channel, a simple span crossing the Little Mystic Channel, a toll plaza structure connecting the two channel spans and deck plate girder approach spans connecting with the existing surface streets in Charlestown and Chelsea.

The main unit over the Mystic River is a three-span, through truss, cantilever bridge consisting of an 800'-10" main span flanked by anchor arms each 361'-8" long. The 800'-10" channel span forms a navigation opening providing a vertical clearance of 135 feet above mean high water.

The simple truss span across the Little Mystic Channel provides a vertical clearance of 100 feet above mean high water for the full width of the waterway.

Southbound traffic, originating in Chelsea, is carried on the upper deck. Access is provided by ramps at Fifth Street and at Everett Avenue in Chelsea. Exit ramps in Charlestown are provided on Henley Street at Park Street and at Water Street.

Northbound traffic, originating in Charlestown, enters the lower deck at Prospect Street and exit ramps are provided in Chelsea at Beacon Street and at Fourth Street.

The toll plaza is located on an elevated structure over the yards of the Boston and Maine Railroad on the Mystic Docks between the Mystic River and the Little Mystic Channel.

NAVIGATION CONSIDERATIONS

A detailed study of navigation requirements was made to determine the proper horizontal and vertical clearances for the channel spans.

An analysis of all ship traffic recorded in the drawtenders' log for the Chelsea North Bridge indicated that the Mystic River carries a very heavy volume of large ocean going vessels. It was disclosed that the largest ship to have used this channel has a maximum height of 123 feet above the water level. Based upon these data and War Department requirements in the past for similar waterways, a vertical clearance of 135 feet above mean high water was established for the bridge.

The Little Mystic Channel is a restricted waterway of considerably less importance than the Mystic River. Analysis of the drawtenders' log for the Chelsea South Bridge showed that the largest vessels known to have used this channel had a height of 97 feet. Considering the limitations of depth and width of the channel and the restricted waterway through the Chelsea South Bridge, it was concluded that a 100-foot vertical clearance was adequate for the span over the Little Mystic Channel.

The horizontal clearance for the main span over the Mystic River was determined by several factors. These included the necessity of keeping the Chelsea North Bridge in operation during construction of the new bridge, economic span lengths as determined by substructure costs, the avoidance of interference with operations of the U. S. Gypsum Company's plant on the Mystic Docks and by

informal discussion of horizontal clearance requirements with the United States District Engineer in Boston. These considerations led to the adoption of a main span length of 800 feet center to center of channel piers with the piers so located as to leave the existing channel openings at the Chelsea North Bridge free for navigation and to leave ample room for ships to dock at the piers of the U. S. Gypsum Company.

Economic considerations dictated the use of a single span across the Little Mystic Channel with the piers located shoreward of the existing pierhead lines, thus removing any question of horizontal clearance from the standpoint of navigation.

An application for approval of the clearances described above was formally submitted to the War Department. In connection with this application, the District Engineer held a public hearing in Boston on March 5, 1947. The purpose of this hearing was to permit interested parties to express their views as to the suitability of the proposed structure from the standpoint of navigation. With minor exceptions all views expressed by navigation interests were in favor of the proposed structure.

Final approval by the War Department is covered by a permit for the construction of the bridge. This instrument was executed by the office of the Under Secretary of War on May 16, 1947. No changes in the clearances requested were required under the terms of the permit. The only condition of the permit involving costs not anticipated when the application was filed is the requirement that a navigation channel be dredged between the fender lines of the existing bridge. This is

a relatively small item of cost and has been included in the estimates herein.

The complete text of the permit is included in the appendix.

Concurrent with the War Department permit procedure, similar action by the Port of Boston Authority resulted in the approval of the proposed bridge by that body and the issuance of a permit the full text of which is included in the appendix.

DESIGN CRITERIA

The bridge has been designed for the heaviest highway loads in accordance with accepted standards. Specifically, the design is based on H20-S16 loading as set forth in the Standard Specifications for Highway Bridges, adopted and published by the American Association of State Highway Officials in 1944. These specifications are generally used for the design of highway bridges and have been adopted as the basis of the design of the Mystic River Bridge. Minor modifications of these specifications will be made since their scope is limited in certain respects to bridges of spans not over 300 feet. However, their adoption as a basic specification for design assures a structure in keeping with the best modern practice.

The layout and design of the bridge as described and illustrated herein may be modified in certain features in the course of the final design. For example, final surveys may indicate the necessity or desirability of modifying the lengths of approach spans, and the detailed development of the design may dictate modification of other features to secure further economies in first or maintenance cost. Such changes will not in any way affect the safety, durability of the structure or its utility from the standpoint of the traffic which will use the bridge.

SURVEYS

Field surveys were conducted along the proposed line of the project to obtain topographic, hydrographic and alignment data required to determine the physical characteristics of the site and accurately locate the bridge and approaches in relation to existing facilities. Survey information was supplemented with data furnished by the Cities of Boston and Chelsea, public utilities and other private interests having installations in the area, thus providing a sound basis for computing the estimates of cost.

The datum for levels used in the surveys was determined from permanent bench marks in the locality. Elevations were based on Mean Sea Level as established by the United States Coast and Geodetic Survey.

All surveys were tied in with the Massachusetts State Coordinate System.

In order to provide a sound basis for the preliminary design and estimate of cost of the substructure, a thorough geological investigation was made of the proposed site.

Data on subsurface conditions were obtained by test borings made at the locations of the main piers and at specified intervals along the line of each approach. They were carried to sufficient depths to determine the character of the subsurface material, and to form the basis for a detailed geological study of the site.

Borings were of the Gow type, made by driving pipe casings and removing material from within the casings by a water jet. As each stratum of material was penetrated, ordinary dry samples were removed and preserved for study and future reference.

The location and logs of all borings are shown on Plates 3, 4 and 5. The geological cross section along the bridge center line, based primarily on the data revealed by the borings, is shown on Plate 9.

Considerable research was done on the known geological history of the Boston area. This history was found to be exceedingly complex, and not completely understood after more than 100 years of extensive study. However, it was established that for practical purposes, only the comparatively recent geological events needed to be considered. A very brief discussion of these events follows.

The Boston Basin is believed to have been originally formed by local warping of the earth's crust long before the glacial period, and filled with deposits of coarse sand, gravel, and shale. The Charles, Mystic and Neponset Rivers flowed across the basin, and,

during a period of land uplift preceding the glacial period, they all cut deep channels into the bedrock. As the region was covered by the glacial ice sheet, it presumably subsided under the weight of ice, and these river channels were partly filled with glacial drift, and later by gravel, sand and mud brought down by the rivers themselves. The consensus is that at the present time the bedrock surface of the larger valleys is some 200 or more feet below sea level. Bedrock elevations at the immediate site of the bridge are discussed at greater length below.

The present coastline in the vicinity of Boston is one of submergence, and Boston Harbor is formed by the drowned mouths of the Mystic, Charles and Neponset Rivers. The local topography is modified by the evidences of extensive glaciation. Most prominent of these are the numerous drumlins, some in the harbor, and some on land. These drumlins are smooth oval hills of compact or stony glacial till, deposited by the glacial ice. Governor's, Winthrop and Deer Islands in the harbor, for example, and on land, Bunker, Breed's and many other rounded oval shaped hills in the vicinity of Boston are such drumlins.

Reference to Plate 9 discloses that all materials encountered above bedrock, excepting made land, and possibly the blue clay deposits, are either of glacial or recent alluvial origin. These several types of materials to be considered with regard to foundation design are as follows:

1. Bedrock - A typically dark bluish gray to brownish gray rock, rather fine grained, and composed chiefly of argillaceous material. It ranges from well stratified to rather massive material, and

through long local usage has become known as the Cambridge Slate, although it is not a true slate. It is considered to constitute the bedrock under the full length of the bridge site.

At the sites of the main river piers, the existence of the solid Cambridge Slate, at the approximate elevations indicated by the Gow type borings, was verified by diamond core drillings, one of which was carried 13.5 feet into bedrock. The configuration of the bedrock surface under the Mystic River in the area between the core borings was compiled from the sources given on Plate 9. Along the remaining portions of the section, the line of maximum penetration of the Gow type borings is represented by a heavy dashed line along the bottom of the section. Because of the nature of these borings, it cannot be definitely stated that this line exactly represents the bedrock surface. However, from a study of other available records of subsurface explorations in the vicinity, and the geological relationships known to be present, it is surmised that this line at least approximates the bedrock surface.

It will be noted that a marked depression centers about Boring No. 5. There is little doubt that it represents an old stream channel, probably of the Mystic River at some former period, but not its original main channel. The deeply buried channel of the pre-glacial predecessor of the Mystic River, 200 or more feet deep, has been mapped as extending southward from Winchester through the Mystic Lakes, across eastern Arlington and western Cambridge, thence between Brighton and Cambridgeport, and across eastern Roxbury and Dorchester Neck to the Old Harbor. The structure of another buried stream channel of lesser importance is clearly defined in the vicinity of Boring No. 19.

2. Boulder Clay - For practical purposes, mapping of the finer gradations between the essentially similar materials composing drumlins, ground moraine, and minor structures of glacial origin was not attempted. These materials are shown on Plate 9 as boulder clay, using the following description as a criterion: "A thoroughly compacted mixture of clay, sand, gravel and boulders. A hardpan." The foregoing is the definition of the Committee on Boston Subsoils of the Boston Society of Civil Engineers. The boulder clay in many places directly overlies the bedrock, and because of its compact composition, has a very favorable load bearing capacity.

3. Modified Till - This term is used to identify the unsorted mixture of firm to hard sand, clay, gravel and possible cobbles and boulders usually overlying the boulder clay. The composition is seen to be very similar to that of the boulder clay, since it is actually a boulder clay that has been somewhat modified by one or more of the processes of weathering, erosion, and reworking by stream action. Therefore, the rock flour and finer materials have generally been removed, and the resulting material is not as compact as the original boulder clay. The transition from the modified till to the boulder clay is in all cases marked by a very appreciable rise in the drive test value furnished by the Gow type borings.

4. Blue Clay - A soft blue clay and sand formation largely fills the major former depressions in the section. It has not been definitely established whether this material was deposited under marine or fresh water conditions. From a practical standpoint, this formation is of interest because pile foundations are required wherever it occurs in any considerable thickness.

5. Alluvial Deposits - The gravels, sands, clays and mud deposits in the upper portions of the section are obviously of recent alluvial origin. They conform closely to the usual types of stream deposits, and cause no unusual problems of foundation design.

An analysis of the boring data and geological cross section reveals considerable variation in the depths to strata of suitable bearing value for the foundations of the structure. The selection of spread footings or pile foundations at each pier location was governed by the results of the subsurface explorations.

In general, pile foundations have been estimated on the basis of steel H piles driven to a bearing capacity of 75 tons.

The two main channel piers, located in the Mystic River are to be founded on bedrock. Their cost is estimated on the basis of open cofferdams, sealed with tremie concrete and unwatered, thus permitting the piers to be constructed in the dry. Protection of the river piers against abrasion due to ice and debris is afforded by granite facing extending above and below the extreme tidal range.

All piers are of reinforced concrete construction as illustrated on Plate 7.

SUPERSTRUCTURE

The main cantilever span over the Mystic River is a three-span, double deck, through truss unit consisting of two anchor arms each 361'-8" long, cantilever arms 206'-8" long and a 387'-6" suspended span making the total length of the main span 800'-10" and an overall length of 1524'-2". Trusses are approximately 45 feet center to center and are of the Warren type subdivided in the panels adjacent to the main piers. The floor system consists of concrete filled steel grid decks supported by cross beams on stringers spanning between floor beams located at each panel point. Steel curbs, guard curbs, emergency sidewalks and handrails are provided. Sway frames and bracing are of conventional design. Plate 8 shows a typical cross section of the main span.

The Little Mystic Channel is bridged by a single, simple span double deck through truss 420 feet long. The structural features of this span, including floor system, truss type and bracing, are similar to those of the main cantilever unit.

The approaches and the spans supporting the toll plaza consist of double deck plate girders supported generally on steel bents.

The ramps in Chelsea and Charlestown are similar in construction to the approach spans.

Plate 8 shows typical cross sections for the approach spans and ramps.

HIGHWAY APPROACHES

The problem of collection and dispersal of traffic at the termini of the bridge requires that sufficient points of ingress and egress be provided so that congestion of surface streets will be minimized. The solution of this problem is essential to the utilization of the capacity of the six traffic lanes provided on the bridge. A double deck structure, which requires bringing the upper and lower levels to street grade at separated points, together with changes to existing streets involving widening, the institution of one-way operation, channelization and the utilization of an existing underpass plus the opening of some new streets furnish the solution to the traffic problem on the surface streets.

Plate 3 shows the general plan evolved for the Charlestown area. The bulk of the traffic bound for Chelsea will pass through the City Square section and follow Chelsea Street to Prospect Street at which point it will go on to the lower deck of the bridge. To facilitate the flow of this traffic, Chelsea Street will be made a one-way street for northbound traffic between City Square and Prospect Street. Local traffic in Charlestown bound for Chelsea may avoid City Square by using Adams Street or some other street crossing Chelsea Street. Southbound traffic on Chelsea Street and other local traffic from the area north of Prospect Street will be routed to a new service street connecting Bunker Hill and Adams Streets whence they may either enter the bridge or proceed to other destinations by way of existing surface streets.

Southbound bridge traffic from Chelsea will be carried on the upperdeck level to the vicinity of Chelsea and Chestnut Streets

at which point the roadway separates into two branches and descends to street grade by ramps. One ramp will carry traffic bound for downtown Boston to grade at Water Street. This street will be widened and traffic will utilize an improved underpass at the Charlestown Bridge (Washington Street) to reach the one-way Warren Street Bridge leading into Boston. Traffic bound for points in Charlestown and the area to the west will follow the second ramp along Henley Street reaching street level at Park Street. Henley Street will be widened and cut through to Rutherford Avenue to carry one-way westbound traffic to this important artery thus diverting a large volume of traffic from City Square.

Plate 5 illustrates the plan evolved for the Chelsea area. Traffic in Chelsea bound for Charlestown will have access to the bridge at Fifth Street and at Everett Avenue. By widening and extending Poplar Street north of Fifth Street, southbound traffic on Washington Avenue will have direct access to the ramp which starts at Fifth Street. This new street will be one-way for southbound traffic. Traffic on Broadway can proceed to the bridge via Fifth Street which will be made one-way in the directions toward the bridge. The Everett Avenue ramp will provide direct access for traffic on that thoroughfare as well as access for traffic from the central business section of Chelsea by way of the loop via Second Street and Walnut Street.

Traffic from Charlestown may descend from the bridge by a ramp which reaches street level at Beacon and Chestnut Streets or may continue on the bridge to the down ramp which comes to street grade at Fourth Street. The ramp to Beacon Street will provide convenient

access to the central business section of Chelsea, the Naval Hospital, and the industries east of Broadway. Through traffic headed north will use the Fourth Street ramp proceeding north on Chestnut to Washington Avenue or east on Fourth Street to Broadway. To facilitate the flow of traffic away from the bridge, Chestnut Street will be made one-way for northbound traffic and Fourth Street one-way in the directions away from the bridge.

TOLL PLAZA

In selecting the location for the toll plaza full consideration was given to sites at both ends of the bridge but it was impossible, because of the thickly built up areas in Chelsea and Charlestown, to select a location which would not involve the destruction of a large number of homes. To avoid this it was decided to locate the toll taking facilities over the Boston and Maine Railroad yards on the double deck girder structure connecting the main cantilever span and the span over the Little Mystic Channel. By flaring the structure in plan it was possible to secure sufficient width for the necessary toll lanes. This provides a suitable plaza with grades slight enough to permit bringing vehicles to a full stop with a minimum of braking action and with adequate space for the diffusion of traffic through the toll lanes without congestion or conflict.

Based upon peak hour operations with three lanes of traffic in one direction on each deck level and on the maximum number of hourly transactions that can normally be handled by one collector, it was determined that seven toll lanes on each level are required. Each lane will be equipped with automatic devices for recording and controlling toll collections. Flashing signals indicating open and closed lanes will be used to channelize traffic.

Toll booths will be constructed of glass and metal and will be so designed as to provide maximum visibility for the collectors. The upper deck toll booths will be covered by a canopy roof.

The Administration Building, housing the administrative offices of the Authority will be built as part of the elevated structure supporting the toll plaza and will be located just beneath

the lower deck level. Facilities for maintenance, operating, accounting, auditing and other appropriate functions will be provided.

Access to the Administration Building as well as to the toll booth levels will be by elevator from the ground level with emergency stairways provided in addition. Adequate parking facilities for executives, employees and business visitors will be constructed under the Administration Building.

The layout of the toll plaza showing the location of toll booths and Administration Building are shown on Plates 4 and 8.

Previous to estimating the cost of acquiring the property lying within the limits of the project, and the property damages that would result from its construction, real estate sales in the vicinity during the past year were investigated, and several appraisers and real estate agents familiar with the area were consulted. Based upon information obtained from these sources, properties to be acquired were assessed, at what was considered fair market values, to determine the estimates of cost.

Allowances were also made in the estimate for easements over the several industrial properties over which the new structure will pass.

Damages to adjoining property caused by the construction of the high level bridge, in the form of reduction of business or depreciation of residential and industrial property, were included in the estimated cost of right of way.

The costs incidental to the acquisition of the property have been included in the total of the right of way and property damage costs. Also included is the estimated cost of razing the buildings on the right of way and filling cellars to present street grades.

The location of the Mystic River Bridge shown herein has been developed after conferences, hearings and meetings with the municipalities, public utilities and others having interests with respect to rights-of-way, easements, etc.

There are no indications that there will be any difficulty in securing any property rights. However, the design of the structure has sufficient flexibility to permit such revisions as may be required in the event of unforseen developments, without material influence upon traffic volumes, time or cost of construction.

RELOCATION OF EXISTING UTILITIES

Numerous utilities, both publicly and privately owned, will be affected by the construction of the new bridge and approaches. In general, piers and footings have been kept outside the limits of existing public streets, thereby holding to a minimum the amount of utility relocation work required. However, at certain locations extensive work cannot be avoided.

The following brief descriptions of the work required in connection with each utility indicate the extent of the work involved. The estimated cost of all the work described is included in Item 25 of the Estimate, "Relocating Existing Utilities."

City of Boston Sewers

Sewers in Henley Street and Foss Street, and in Chelsea Street at Henley Street and at Mt. Vernon Street, will be disrupted by the proposed structures and must be re-located. A new collecting sewer will be necessary in the new service street on the west side of the structure between Mt. Vernon Street and Bunker Hill Street. This new sewer will furnish sewer service to the new frontage along this street and will intercept the sewers in Prospect, Tremont and Ferrin Streets. The 12 inch and 42 inch sewers in Gray Street will require protection against the superimposed loads of the filled approach.

City of Boston Water Lines

Numerous water lines will be disrupted by the proposed structures and must be re-located. A new water main in the above mentioned new service street will be required to furnish water service in this new street and to maintain service in Tremont and Ferrin Streets.

Metropolitan Water District.

The present water main crossing Mystic River consists of a section of 30-inch pipe carried on a special structure, and a section of 24-inch pipe in a tunnel under that portion of the river now bridged by the movable span. The portion of this line which is not in tunnel will be removed with the old bridge. An entirely new water main across Mystic River is recommended. In making studies of the cost of this work, provision was made for the construction of a 30-inch flexible joint submarine pipe to be laid in a trench below the limit of future dredging operations, and equipped with automatic control valves on each side of the river.

City of Chelsea Water Lines and Sewers.

Various water lines and sewers in Chestnut Street, Poplar Street and at the entrance to the U. S. Naval Hospital will conflict with the piers and footings of the proposed structures and must be relaid.

Boston Elevated Railway Company.

The southbound tracks of the Boston Elevated Railway Company in Chelsea Street between City Square and Bunker Hill Street must be rerouted because of the institution of one-way traffic flow in Chelsea Street. New tracks for southbound traffic are proposed in the new service street, Common Street and Park Street, connecting to the present tracks in Park Street at Joiner Street.

Boston Consolidated Gas Company.

Gas lines in the area between Joiner Street and Bunker Hill Street in Charlestown, and in Chestnut and Poplar Streets, in Chelsea,

Boston Consolidated Gas Company.

will be disrupted by the various structures to be constructed in those areas. New gas lines, varying in size from 3 inches to 12 inches will be required.

Boston Edison Company.

Underground electric lines of the Boston Edison Company will be disrupted by the filled approaches and piers at the Charlestown end of the project, and by the piers of the girder spans through the yard of the Boston and Maine Railroad. These lines must be replaced by new conduits in suitable locations.

The Boston Edison Company crosses Mystic River by means of a section of conduit line on the existing bridge and a section of submarine cable across the navigable channel. These lines will be destroyed when the existing bridge is removed.

Adequate conduit for electric lines will be provided on the proposed bridge across Mystic River.

New England Telephone and Telegraph Company.

Underground communications lines of the New England Telephone and Telegraph Company will be disrupted by the filled approaches in Charlestown and must be replaced by new conduits in suitable locations.

The communications lines crossing Mystic River consist of a section of conduit on the existing fixed bridge and a section of submarine cable across the navigable channel. When the existing bridge is removed these lines will be destroyed. Adequate conduit for communications lines will be provided on the proposed bridge across Mystic River.

Boston and Maine Railroad.

The piers and footings of the proposed girder spans through the yard of the Boston and Maine Railroad will conflict with existing water lines, steam lines and drainage lines. These lines, varying in size from 1½ inches to 16 inches, must be relaid so as to avoid the proposed structures.

A 100,000-gallon water tank is now standing in the railroad yard on the line of the proposed bridge. A new tank must be erected in a different location, and the existing tank removed.

U. S. Naval Hospital.

Various water lines, sewers and underground conduits within the grounds of the U. S. Naval Hospital in Chelsea will be disrupted by the piers of the proposed structure and must be replaced by new lines in suitable locations.

ESTIMATED COST OF THE PROJECT

The estimated cost of the project may be summarized as follows:

A.	Preliminary Expenses		$ 80,000
B.	Rights of Way, Property Damages, Etc.		2,810,000
C.	Construction Cost		
	Substructure, Abutment to Abutment	$ 3,590,000	
	Superstructure	11,983,000	
	Approach Facilities	1,900,000	
	Sub-total	$17,473,000	
	Contingencies 10%	1,747,000	
	Total Construction Cost		19,220,000
D.	Engineering		1,153,000
E.	Legal, Administrative and Overhead Costs		138,000
F.	Interest during construction and for one year thereafter		2,599,000
	TOTAL COST OF PROJECT		$26,000,000

The total cost of the project represents the amount of money which must be made available to the Mystic River Bridge Authority from the sale of the bonds and does not include the cost of financing.

In the above tabulation, Preliminary Expenses include all expenses incurred by the Authority prior to the sale of the bonds except the cost of the engineering report. These costs have been paid out of funds appropriated from the general fund of the Commonwealth and must be reimbursed by the Authority out of the proceeds of the bonds issued.

Rights of Way, Property Damages, Etc., have been estimated on the basis hereinbefore described and are considered to cover all costs incidental to the right of way, including purchase of land and buildings at a fair price on today's market, the costs incidental to acquiring the properties, consequential damage to nearby properties and the demolition of the existing buildings on the right of way.

Construction costs are estimated on the basis of today's prices (August, 1947). The largest single item of cost is the steel superstructure of the bridge. The unit prices per ton used for the various classes of steel have been established after consultation with the major steel fabricating companies. The estimated steel prices include the effect of all price increases up to the present time, including that resulting from the recent increases in wages in the coal industry, plus an allowance, based on the advice of the steel companies to cover possible further price increases in steel by the time the superstructure contracts are let. A typical breakdown of the items included in the cost per ton of steel (in this case carbon steel in the approach girders) is as follows:

Steel, base price	$ 56.00 per ton
Size, shape and other mill extras	10.00 " "
Shop drawings	4.00 " "
Fabrication	47.60 " "
Shop painting	2.40 " "
Freight	8.40 " "
Erection	86.60 " "
Field Painting	10.00 " "
	$ 225.00 per ton

The unit prices of all other major items of cost have been fixed after consultation with contractors experienced in the type of work involved. To provide for unforeseen contingencies, 10% has been added to the estimated construction cost. The detailed estimates of quantities and unit prices are tabulated in the appendix.

Engineering costs include the engineering report, the preparation of complete construction plans, specifications and contract documents, all surveys, general supervision of construction and inspection of workmanship and materials, assistance to the Authority in securing proposals, analysis of bids and award of contracts, preparation of estimates, shop and mill inspection of materials and general coordination of all construction and material contracts.

Legal, Administrative and Overhead Costs include salaries and office costs of the Authority, legal services in connection with contractual matters and other general expenses of a similar nature in the period from the sale of the bonds until the bridge is opened to traffic. Detailed estimates of these costs are included in the appendix.

Interest during construction has been estimated on the basis of an interest rate of 2 3/4% over a period of 3 1/2 years on a bond issue in the principal amount of $27,000,000, which will provide funds for expenses not included in the above tabulation. The 3 1/2 year period covers the actual time of construction plus one year thereafter.

OPERATING REVENUES

A "Final Report on Traffic and Revenues, Proposed Mystic River Bridge, Boston, Massachusetts," dated July, 1947, has been prepared by DeLeuw, Cather & Company, Consulting Engineers of Chicago, Illinois, from which the following is quoted:

"Estimates of potential traffic on the proposed bridge were based on analyses of existing relevant data supplemented by traffic counts and by origin-destination surveys of traffic over the present Chelsea Bridge, other bridges in the vicinity and the Sumner Tunnel. Other factors considered were trends in population, motor vehicle registrations, gasoline consumption and increases in traffic induced by the added convenience of improved facilities.

"Estimates of annual vehicular traffic over the proposed bridge at 5-year intervals from 1950 to 1978 are as follows:

"Table 1

"Year	Estimated Annual Traffic
1950	13,580,000
1955	14,920,000
1960	16,030,000
1965	16,840,000
1970	17,670,000
1975	18,100,000
1978	18,290,000

"The basis for this estimate of traffic is that access to the proposed bridge will be over surface streets with such improvements as are necessary to make the new bridge conveniently accessible. We have collaborated with J. E. Greiner Company on proposals for improvements to

surface streets and approach facilities. We are satisfied that the estimated volume of traffic can be accommodated with the recommended layouts. Traffic estimates were also made on the assumption that expressway type of facilities eventually will be built from each end of the new bridge, as contemplated in the long range plans of the Department of Public Works.

"Peak hour traffic with no expressway development whatever is estimated to reach an hourly total of 3,750 * mixed vehicles in one direction by the year 1970. This figure would be about 4,750 if all of the projected expressways are completed by that time. We conclude that three lanes are required for traffic in each direction and we, therefore, recommend a six-lane bridge.

"Annual gross revenues have been estimated on the basis of the following toll schedule:-

> 15¢ for a single ticket, 2 tickets for 25¢ and 10 tickets for $1.00 for automobiles, and tolls for commercial vehicles graduated to a maximum of 40¢

The following table sets forth these estimated revenues, ... at five-year intervals from 1950 to 1978...:

* 3,870 in 1978

"Table 2

"ESTIMATED REVENUES ....."

"Year	Gross Revenues
1950	$1,982,000
1955	2,175,000
1960	2,337,000
1965	2,458,000
1970	2,580,000
1975	2,641,000
1978 *-*-*-*-*	2,669,000

"IMPROVEMENTS TO TRIBUTARY STREETS

"Tributary streets at both ends of the proposed bridge will need to be improved as recommended on layouts prepared by J. E. Greiner Company, in which we have collaborated. The new bridge approaches will cut off access from certain existing tributary arteries so that the remaining streets must be made to function with maximum efficiency by widening roadways, installing traffic signals and inaugurating one-way movement ....."

--*-*-*-

"..... At the same time, these facilities (the construction of express highways) would relieve local streets in the vicinity of the bridge of substantial volumes of through traffic. The expressways would not be adequate substitutes, however, for major improvements in the tributary street system since large portions of the bridge traffic will always be generated by activities in and near Chelsea and Charlestown."

The above quotations summarize the findings of the traffic engineers with respect to predicted revenues which will be realized from the operation of the project. The traffic engineers emphasize the necessity of providing convenient, adequate access facilities in connection with the construction of the bridge proper. The improved layout of approach streets to which DeLeuw, Cather & Company refer are shown upon Plates 3 and 5 of this report. The cost of all phases of this work is included in the estimates presented herein. The number of traffic lanes provided by the proposed structure will be, as recommended by DeLeuw, Cather & Company, three in each direction.

MAINTENANCE AND OPERATING EXPENSES

Annual maintenance and operating expenses are shown in detail in the Appendix, with a summary presented below. These costs are based upon estimated traffic and revenue which have been predicted for the year 1955. All items of expense have been included.

Estimated maintenance and operating expenses are summarized in the following tabulation:

General Administration	$ 76,000
Maintenance	46,000
Operation	163,000
Insurance and Fidelity Bonds	31,000
TOTAL	$316,000

In addition to current maintenance and operating expenses, there should be established Reserve Funds, to which annual payments should be made in order to provide funds for major repairs, replacement of equipment and other expenditures which will occur at infrequent intervals. The following tabulation summarizes these items:

RESERVE FUNDS

Major Renewals and Replacements	$ 4,000
Painting	35,000
Insurance (to cover deductible)	5,000
Equipment Renewals	1,000
TOTAL	$45,000

PLAN OF PROCEDURE

Plate 10 presents in graphical form a plan of procedure which contemplates completing the project and opening it to traffic on February 1, 1950. The prosecution of the work in conformance with the proposed schedule is dependent upon the sale of bonds and the deposit of funds with the Trustee on or before September 1, 1947.

The construction phases of the project are controlled by two major factors, namely, the completion of the contract plans and specifications for the bridge superstructure within eight months after notice to proceed and the completion by the superstructure contractor of fabrication and erection of the bridge within twenty months after the award of contract. The total time interval between commencement and completion of these major phases of the project is sufficient to allow coordination and completion of all other phases of the work.

The date of notice to proceed with contract plans and specifications has been set at September 1, 1947. This is based on the assumptions that all preliminary work will have been completed, bonds will have been sold, and funds will have been deposited with the Trustee on or before that date.

The planning and construction has been broken down into four major contracts covering the following portions of the work:

1. Bridge Substructure (Abutment to Abutment)
2. Bridge Superstructure
3. Approach Facilities
4. Toll Booths, Administration Building, Lighting, Etc.

PLAN OF PROCEDURE

Preparation of plans for the bridge substructure will proceed simultaneously with those for the superstructure. It is contemplated that the substructure plans will be completed in 4 months, thus allowing sufficient time for completion of the piers by the time the superstructure contractor is ready to begin erection of the steel work. The last two contracts, not being intimately connected to the first two, can proceed more or less independently and simultaneously with those covering the bridge structure itself. These will be fitted into the general schedule and will be completed by the time the bridge is ready for traffic.

The final stage of the project, the removal of the Chelsea North Bridge and dredging of the channel, must be deferred until the new bridge is completed and open to traffic. This work can be completed by April 1, 1950, and will mark the completion of all construction operations.

The proposed new bridge over the Mystic River, which has been described in this report, would provide marked improvement in the available facilities for traffic between Charlestown and Chelsea and at the same time would practically eliminate interference with the movement of shipping in the area.

The detailed development of the construction plans and specifications will follow the general nature of the details which are shown and described in the report. Sufficient latitude in the design and estimates is present to permit minor changes which the further advance of studies may disclose as necessary or desirable, without affecting the physical or financial integrity of the project.

The engineering studies show that based on a total bond issue of $27,000,000 the estimated debt service coverage will be approximately 1.34 times throughout the contemplated life of the loan as indicated by the following summary:

Average annual gross revenue for period of loan, 1947 - 1977	$ 2,389,000
Average annual maintenance and operation expense	361,000
Balance available for debt service	$ 2,028,000
Average annual debt service, based on total amount of bonds being retired in 25 years with equal annual payments of principal and interest	$ 1,508,000
Average annual surplus	$ 520,000

The above indicates debt service coverage as follows:

Annual amount available for debt service	$ 2,028,000
Annual debt service	$ 1,508,000

Debt service coverage $\$ \frac{2,028,000}{1,508,000} = 1.34$

The indicated coverage provides a cushion for future contingencies, possible reduction in toll rates, or retirement of bonds more rapidly than sinking fund schedules anticipate.

To provide the metropolitan area of Boston with necessary improved facilities for the expeditious movement of traffic between Charlestown and Chelsea at the site of the present Mystic River Bridge, we recommend that the Authority, following its consideration of this report and other matters pertinent thereto, negotiate the sale of securities for the purpose of securing funds for the construction of the project.

APPENDIX A

CONSTRUCTION COSTS

LEGAL, ADMINISTRATIVE AND OVERHEAD COSTS

SUBSTRUCTURE

No.	Item	Quantity	Unit Price	Amount
1.	Removal of Existing Paving	1,500 S.Y.	$ 1.00	$ 1,500.00
2.	Protection of Existing Bldg. & Structures	Lump Sum		6,000.00
3.	Dry Excavation, Above EL.0.0.	27,000 C.Y.	3.00	81,000.00
4.	Wet Excavation, Below EL.0.0.	18,000 C.Y.	15.00	270,000.00
5.	Underwater Rock Excavation	600 C.Y.	40.00	24,000.00
6.	Special Cleaning of Underwater Foundation	900 S.Y.	10.00	9,000.00
7.	Load Test for Foundation	5 each	200.00	1,000.00
8.	Furnishing Steel Bearing Piles	88,000 L.F.	3.50	308,000.00
9.	Caps and Points for Steel Bearing Piles	1,200 each	25.00	30,000.00
10.	Splicing Steel Bearing Piles	600 each	20.00	12,000.00
11.	Driving Steel Bearing Piles	88,000 L.F.	2.00	176,000.00
12.	Load Test for Steel Bearing Piles	15 each	1,400.00	21,000.00
13.	Tremie Concrete	6,400 C.Y.	30.00	192,000.00
14.	Class B. Base Concrete	20,150 C.Y.	40.00	806,000.00
15.	Class A. Base Concrete	11,200 C.Y.	50.00	560,000.00
16.	Class A. Structure Concrete	11,000 C.Y.	60.00	660,000.00
17.	Reinforcing Steel	3,800,000 Lbs.	0.09	342,000.00
18.	Granite Facing	13,000 C.F.	6.00	78,000.00
19.	Reinforced Concrete Paving	2,000 S.Y.	4.00	8,000.00
20.	Porous Backfill	500 C.Y.	6.00	3,000.00
21.	Dampproofing	1,000 S.Y.	1.50	1,500.00
		TOTAL - SUBSTRUCTURE		$3,590,000.00

CONSTRUCTION COSTS

SUPERSTRUCTURE

No.	Item	Quantity	Unit Price	Amount
1.	Approach Girder Spans - Carbon Steel	14,400 tons	$ 225.00	$3,240,000.00
2.	Approach Girder Spans - Silicon Steel	12,200 tons	245.00	2,989,000.00
3.	South Channel Span - Carbon Steel	1,100 tons	300.00	330,000.00
4.	South Channel Span - Silicon Steel	810 tons	330.00	267,300.00
5.	Main Span - Carbon Steel	4,020 tons	335.00	1,346,700.00
6.	Main Span - Silicon Steel	4,330 tons	365.00	1,580,450.00
7.	I Beam Lok Filled Floor	783,000 S.F.	2.25	1,761,750.00
8.	C.I. Drains and Pipes	Lump Sum		147,800.00
9.	Lighting	Lump Sum		70,000.00
10.	Administration Building and Toll Facilities	Lump Sum		250,000.00
		TOTAL - SUPERSTRUCTURE		$ 11,983,000.00

APPROACH FACILITIES

No.	Item	Quantity	Unit Price	Amount
1.	Clearing and Grubbing	Lump Sum		$ 500.00
2.	Removal of Existing Paving	14,000 S.Y.	$ 1.50	21,000.00
3.	Protection of " Bldgs.& Struc.	Lump Sum		10,000.00
4.	Borrow Excavation	38,600 C.Y.	2.00	77,200.00
5.	Dry Excavation	15,700 C.Y.	3.00	47,100.00
6.	Class A Structure Concrete	9,470 C.Y.	60.00	568,200.00
7.	Reinforcing Steel	950,000 Lbs.	0.09	85,500.00
8.	Dampproofing	7,000 S.Y.	1.50	10,500.00
9.	Waterproofing	1,000 S.Y.	5.00	5,000.00
10.	Porous Backfill	4,700 C.Y.	6.00	28,200.00
11.	Drainage	Lump Sum		28,400.00
12.	Reinforced Concrete Paving	29,000 S.Y.	5.00	145,000.00
13.	Concrete Parapet on Ret.Walls	5,800 L.F.	4.00	23,200.00
14.	9" Granite Curb	5,800 L.F.	3.00	17,400.00
15.	6" Granite Curb	8,800 L.F.	2.50	22,000.00
16.	Metal Railing on Ret. Walls	5,800 L.F.	4.00	23,200.00
17.	Light Standards and Wiring	Lump Sum		30,000.00
18.	Traffic Signs	Lump Sum		2,000.00
19.	Relocating Existing Utilities	Lump Sum		440,000.00
20.	Landscaping	Lump Sum		3,000.00
21.	Facilities for Resident Engineer	Lump Sum		12,000.00
22.	Maintenance of Traffic	Lump Sum		2,600.00
23.	Enlarging Water St. Underpass	Lump Sum		200,000.00
24.	Removal of Existing Bridge	Lump Sum		80,000.00
25.	Dredging	Lump Sum		18,000.00
	TOTAL - APPROACH FACILITIES			$ 1,900,000.00

LEGAL, ADMINISTRATIVE AND OVERHEAD COSTS

Authority Members, Per Diem	$ 40,000.00
General Manager	18,750.00
General Counsel	18,750.00
Secretary	13,000.00
Stenographic and clerical	15,375.00
Travel Expenses	4,000.00
Office Rent	3,750.00
Office Supplies	5,000.00
Telephone, Telegraph and Postage	4,500.00
Automobile	4,375.00
Chauffer	5,000.00
Miscellaneous	5,500.00
TOTAL	$ 138,000.00

NOTE: Estimated costs cover 2½ year period.

APPENDIX B

MAINTENANCE AND OPERATING EXPENSES

MAINTENANCE AND OPERATING EXPENSES

GENERAL ADMINISTRATION

Authority Members, Per Diem	$ 16,000.00
Authority Members, Travel Expenses	500.00
Authority Office Staff	16,000.00
Trust Indenture Expenses:	
Audits	7,500.00
Trustee	15,000.00
Consulting Engineers	9,000.00
Coupon Agents	1,500.00
Superintendent	4,500.00
Telephone, Telegraph and Postage	300.00
Stationery, Supplies and Printing	1,200.00
Janitor Service	1,800.00
Heat and Light (Administration Building)	1,000.00
Association Memberships, Periodicals	200.00
Miscellaneous	1,500.00
TOTAL	$76,000.00

MAINTENANCE AND OPERATING EXPENSES

MAINTENANCE

Maintenance Labor:	
General	$19,200.00
Painting	11,800.00
Maintenance Material:	
General	2,000.00
Paint	10,000.00
Emergency Equipment (Crash Truck)	1,200.00
Miscellaneous	1,800.00
TOTAL MAINTENANCE EXPENSES	$46,000.00

OPERATION

Toll Collection, Salaries	$110,000.00
Traffic Control, Salaries	25,000.00
Uniforms	3,000.00
Tickets	4,000.00
Lighting (Power and Lamp Renewal)	13,000.00
Locker Room Expense	500.00
Snow Removal and Cindering	5,000.00
Miscellaneous	2,500.00
TOTAL OPERATING EXPENSES	$ 163,000.00

MAINTENANCE AND OPERATING EXPENSES

INSURANCE AND FIDELITY BONDS

Multi-risk	$ 9,600.00
Use and Occupancy	1,350.00
Public Liability and Property Damage	16,750.00
Bonds, Fidelity	1,700.00
Bonds, Sheriff's	125.00
Glass	50.00
Messenger, Holdup, Etc.	500.00
Fire	350.00
Miscellaneous	575.00
TOTAL	$31,000.00

RESERVE FUNDS

Major Renewals and Replacements	$ 4,000.00
Painting	35,000.00
Insurance (to cover deductible)	5,000.00
Equipment Renewals	1,000.00
TOTAL	$45,000.00

APPENDIX C

WAR DEPARTMENT PERMIT

PORT OF BOSTON AUTHORITY PERMIT

C O P Y

WAR DEPARTMENT
Corps of Engineers
Office of Division Engineer
New England Division
31 St. James Avenue
Boston 16, Mass.

26 May 1947

Mystic River Bridge Authority
6 Beacon Street
Boston, Massachusetts

Attention: Ephraim A. Brest
Chairman

Gentlemen:

There is enclosed instrument approving location and plans of a bridge to be constructed across Mystic River 0.08 of a mile above its mouth, between Charlestown and Chelsea and across Mystic River South Channel (Little Mystic), 0.24 of a mile above its mouth in Charlestown, Massachusetts. This instrument was executed by the Acting Chief of Engineers on 13 May 1947 and by the office of the Under Secretary of War on 16 May 1947.

Your attention is invited to the conditions set forth in the said instrument. You are especially requested to notify this office of the date of commencement and of the date of completion of the construction in order that such supervision as shall be considered necessary may be exercised.

You are cautioned that if any material changes in the location or plans of the structure or work are found necessary on account of unforeseen or altered conditions or otherwise, revised plans should be submitted promptly to this office to the end that these revised plans, if found unobjectionable from the standpoint of navigation, may receive the approval required by law before the work thereon is begun.

FOR THE DIVISION ENGINEER:

Very truly yours,

(Sd.) K. M. PATTEE
Lt. Colonel, Corps of Engineers
Executive Officer

1 Incl.
Instrument

C O P Y

APPROVAL OF LOCATION AND PLANS OF BRIDGE

WHEREAS by Title V of an act of Congress approved August 2, 1946, entitled General Bridge Act of 1946 (Public Law 601--79th Congress) the consent of Congress was granted for the construction, maintenance, and operation of bridges and approaches thereto over the navigable waters of the United States;

And whereas section 502(b) of said act provides that: "the location and plans for such bridges shall be approved by the Chief of Engineers and the Secretary of War before construction is commenced, and, in approving the location and plans of any bridge, they may impose any specific conditions relating to the maintenance and operation of the structure which they may deem necessary in the interest of public navigation, and the conditions so imposed shall have the force of law;"

And whereas the MYSTIC RIVER BRIDGE AUTHORITY has submitted plans and a map of the location of a bridge to be constructed across MYSTIC RIVER, 0.08 miles above the mouth, between Charlestown and Chelsea and across MYSTIC RIVER SOUTH CHANNEL (LITTLE MYSTIC), 0.24 miles above the mouth in Charlestown in the State of Massachusetts.

Now therefore, This is to certify that the location and attached plans are hereby approved by the Chief of Engineers and by the Secretary of War, pursuant to the above-mentioned act of Congress, subject to the following conditions:

1. The division engineer in charge of the locality within which the bridge is to be built may supervise its construction in order that said plans shall be complied with.

2. All work shall be so conducted that the free navigation of the waterway shall not be unreasonably interfered with and the present navigable depths shall not be impaired. The channel or channels through the structure shall be promptly cleared of all falsework, piling, or other obstructions placed therein or caused by the construction of the bridge, to the satisfaction of the said division engineer, when in his judgment the construction work has reached a point where such action should be taken, and in any case not later than ninety days after the bridge has been opened to traffic.

3. The approval hereby granted shall cease and be null and void unless the actual construction of the bridge be commenced within 2 years and completed within 4 years from the date of this instrument.

4. No deviation from the approved plans shall be made either before or after completion of the structure unless the modification of said plans has previously been submitted to and received the approval of the Chief of Engineers and of the Secretary of War.

5. That all parts of the existing bridge across Mystic River including all piles and pile stubs, between abutments, with the exception of the northerly rest pier fender, shall be entirely removed to the satisfaction of the said division engineer, not later than 180 days after the said new bridge shall have been opened to traffic; and that a navigation channel 320 feet wide between the lines of the Channelward faces of the rest pier fenders of the existing bridge across Mystic River shall be cleared of all obstructions, except ledge rock, to a depth of at least 30 feet at mean low water, not later than 90 days after the said new bridge shall have been opened to traffic.

WITNESS my hand this 13th day of May 1947

(Signed) R. C. CRAWFORD
Brigadier General
Acting Chief of Engineers

IN WITNESS WHEREOF I have hereunto set my hand by direction of the Under Secretary of War this 16th day of May 1947.

S. C. BORZILLERI
Major, A.C.,
Assistant.

C O P Y

FORM WD 54 C O P Y

THE COMMONWEALTH OF MASSACHUSETTS

No. 34

Whereas, Mystic River Bridge Authority

of Boston-------, in the county of Suffolk--------- and Commonwealth aforesaid, has applied to the port of Boston Authority for license to construct a high level highway bridge in and over the tide-waters of Mystic River and Little Mystic Channel in the cities of Boston and Chelsea-------
---

and has submitted plans of the same; and whereas due notice of said application, and of the time and place fixed for a hearing thereon, has been given, as required by law, to the Mayor and Council of the cities of Mayor and Alderman Boston and Chelsea;

Now, said Authority, having heard all parties desiring to be heard, and having fully considered said application, hereby, subject to the approval of the Governor and Council, authorizes and licenses the said Mystic River Bridge Authority----------, subject to the provisions of the ninety-first chapter of the General Laws, and of all laws which are or may be in force applicable thereto, to construct a high level highway bridge in and over the tide-waters of Mystic River and Little Mystic Channel in the cities of Boston and Chelsea, on the west side of the existing Chelsea Street bridge and viaduct in conformity with the accompanying plan.

The proposed bridge over the Mystic River shall have two piers in the tide-waters of the Mystic River with a minimum clearance between piers of 700 feet, the overhead clearance for passage of vessels shall not be less than 135 feet at mean high water elevation plus 4.58.

The proposed bridge over the Little Mystic Channel shall have a clear span with overhead clearance of 100 feet at mean high water.

This license is granted subject to the following terms and conditions; After the high level bridge is constructed over the Mystic River, the existing Mystic River Bridge shall be removed as herein stipulated - all piles in tidewater shall be pulled - and the turn table foundation, center fender pier, north and south abutments and fender piers of the draw span shall be entirely removed and any shoals above the depth of 30 feet at mean low water resulting from the removal of the aforementioned structures shall be dredged to a depth of 30 feet at mean low water. The north abutment fender pier of the draw span shall be left in place for a navigational aid until such time as the channel underneath the proposed bridge is widened by the U.S. Government to permit safe navigation and then said fender pier is to be removed by the Mystic River Bridge Authority.

This license is granted subject to the laws of the United States.

The plan of said work, numbered-------34-------is on file in the office of said Authority and duplicate of said plan accompanies this License, and is to be referred to as a part hereof.

Nothing in this License shall be so construed as to impair the legal rights of any person.

This License shall be void unless the same and the accompanying plan are recorded within one year from the date hereof, in the Registry of Deeds for the District of the County of Suffolk.

In Witness Whereof, said Port of Boston Authority have hereunto set their hands this sixth day of May in the year nineteen hundred and forty seven.

Gerald Henderson)
John F. Fitzgerald) Port of Boston
L. M. Edgehill) Authority

THE COMMONWEALTH OF MASSACHUSETTS

Boston, June 11, 1947

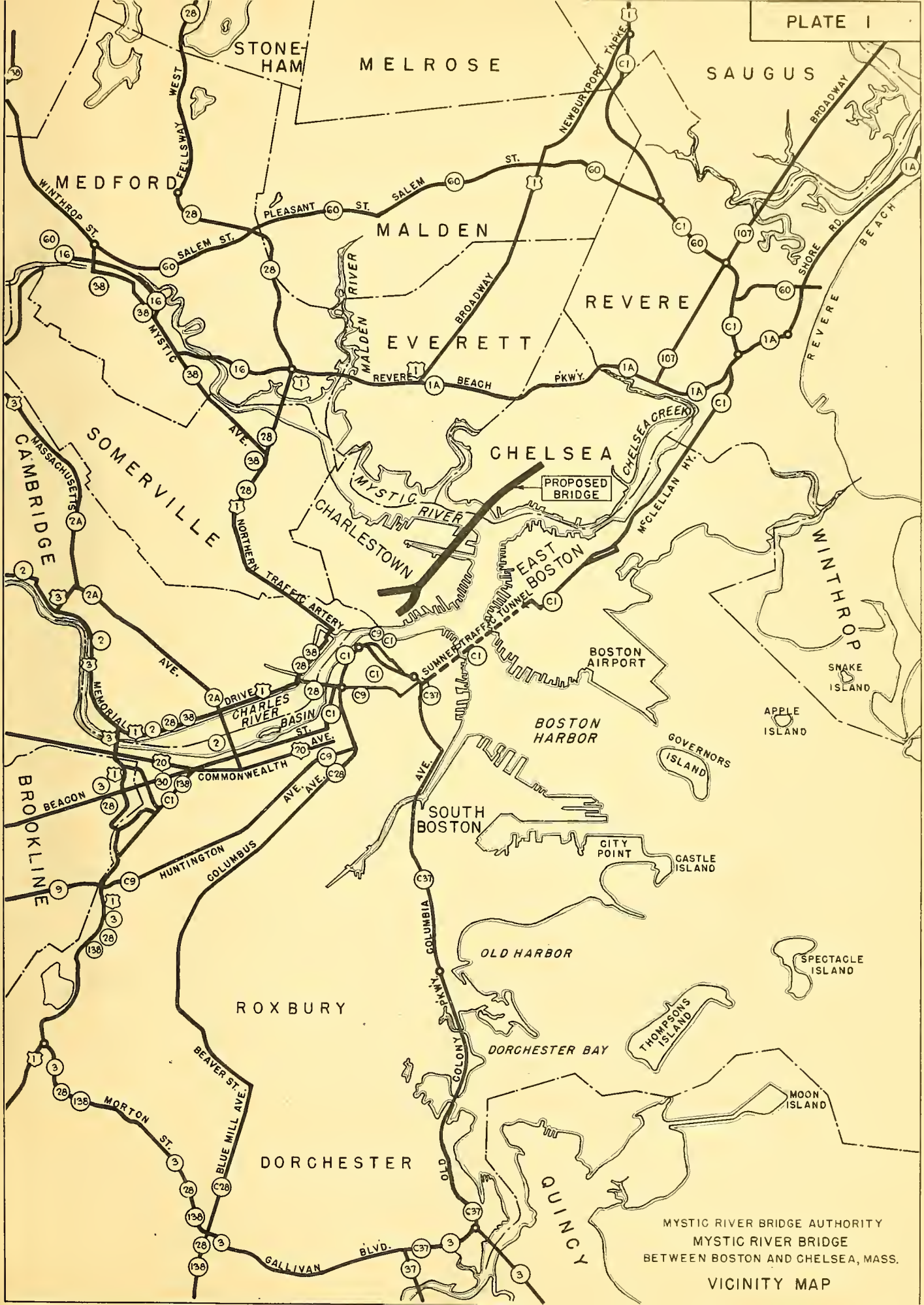
Approved by the Governor and Council.

(Signed) G..Bruce.Robinson.....
Executive Secretary

C
O
P
Y

APPENDIX D

PLATES



MYSTIC RIVER BRIDGE AUTHORITY

MYSTIC RIVER BRIDGE

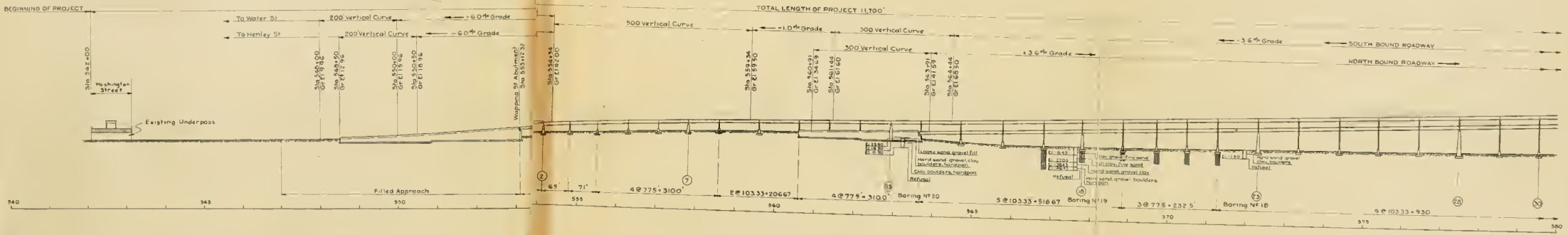
BETWEEN BOSTON AND CHELSEA, MASS.

VICINITY MAP


PLATE 2
MYSTIC RIVER BRIDGE AUTHORITY
MYSTIC RIVER BRIDGE
BETWEEN BOSTON AND CHELSEA, MASS.
LOCATION PLAN
1000' 0 1000' 2000'
ADAPTED FROM U.S.C.&G.S. CHART NO 248
CHELSEA
CHELSEA RIVER
CHARLESTOWN
EAST BOSTON
MYSTIC RIVER
Island End R.
Naval Hospital
Mystic Wharf
Little Mystic Channel
Wood Island Park
storage yard
Cable and pipeline area
23 FEET JUNE 1945
BULKHEAD
Ferry Slip
Charles River Dam

PLATE 3

PLAN



ELEVATION

Elevations Above Mean Sea Level

MYSTIC RIVER BRIDGE AUTHORITY
MYSTIC RIVER BRIDGE
BETWEEN BOSTON AND CHELSEA, MASS.
GENERAL LAYOUT
BOSTON APPROACH

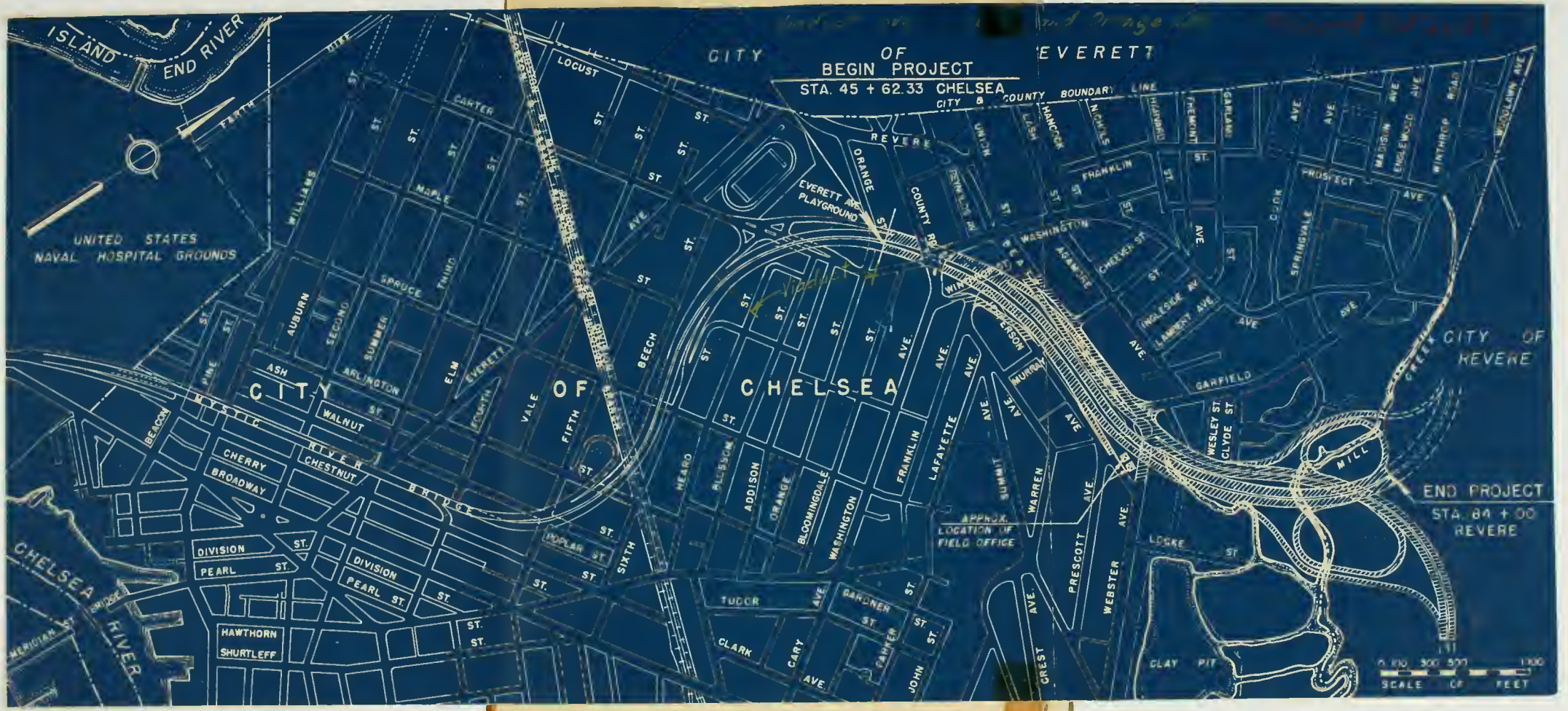
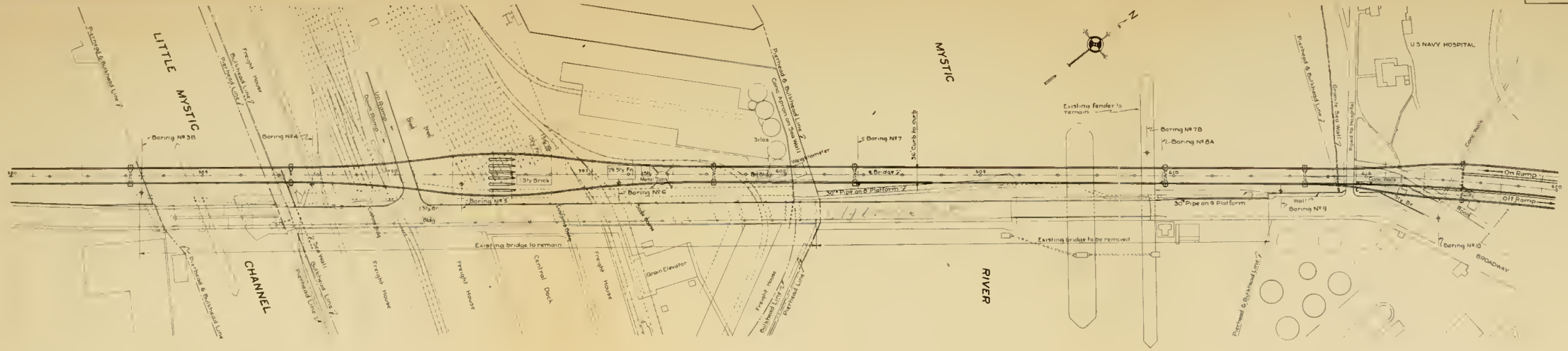
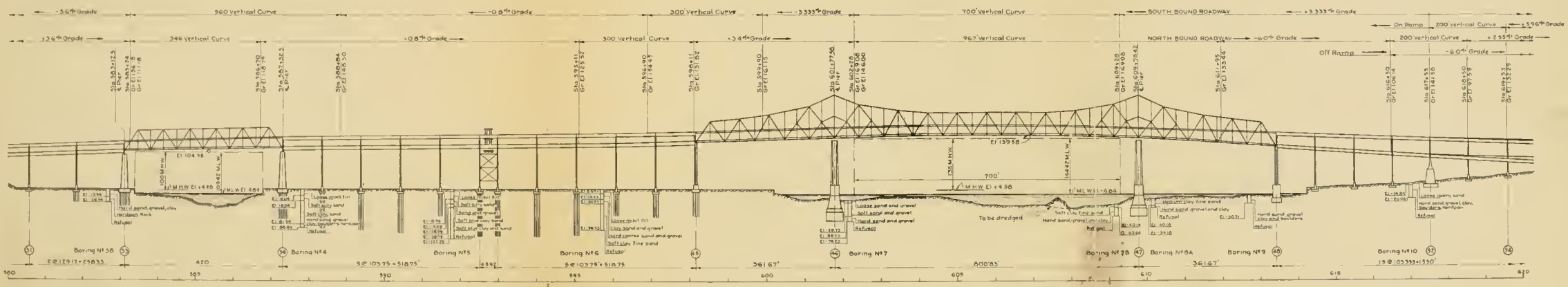

ISLAND END RIVER
CITY OF EVERETT
BEGIN PROJECT
STA. 45 + 62.33 CHELSEA
CITY & COUNTY BOUNDARY LINE
UNITED STATES NAVAL HOSPITAL GROUNDS
EVERETT AVE. PLAYGROUND
CITY OF CHELSEA
CITY OF REVERE
APPROX. LOCATION OF FIELD OFFICE
END PROJECT
STA. 84 + 00
REVERE
MILL
CHELSEA RIVER
MYSTIC RIVER BRIDGE
SCALE OF FEET

PLATE 4



PLAN



ELEVATION

Elevations Above Mean Sea Level

MYSTIC RIVER BRIDGE AUTHORITY

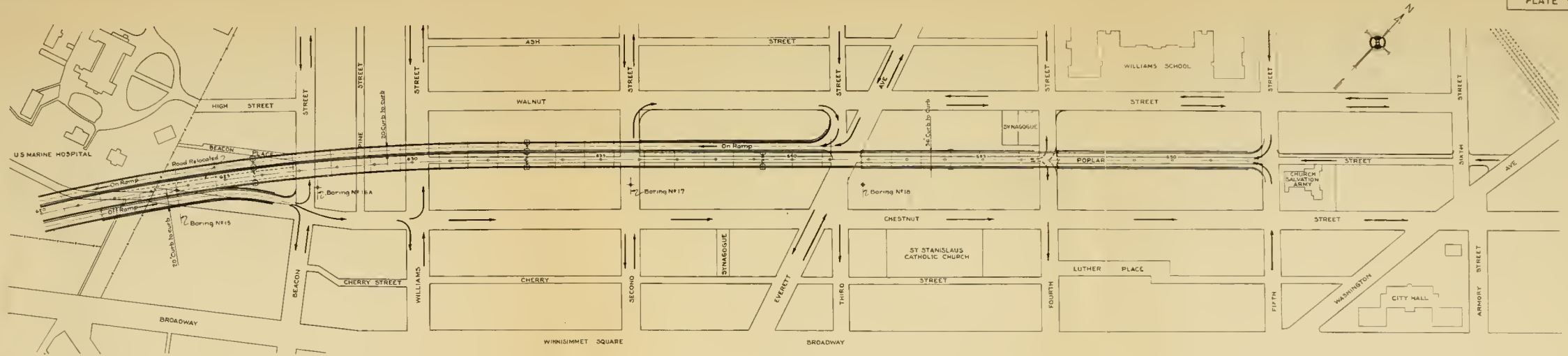
MYSTIC RIVER BRIDGE

BETWEEN BOSTON AND CHELSEA, MASS.

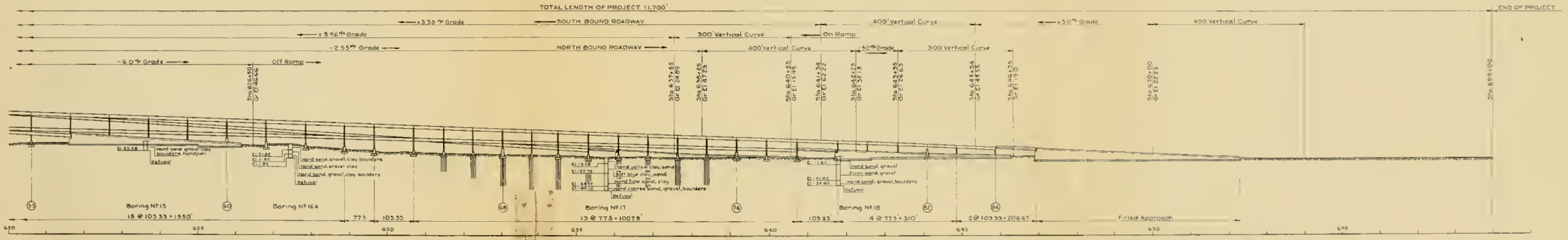
GENERAL LAYOUT

HIGH LEVEL BRIDGE

PLATE 5



PLAN



ELEVATION

Elevations Above Mean Sea Level

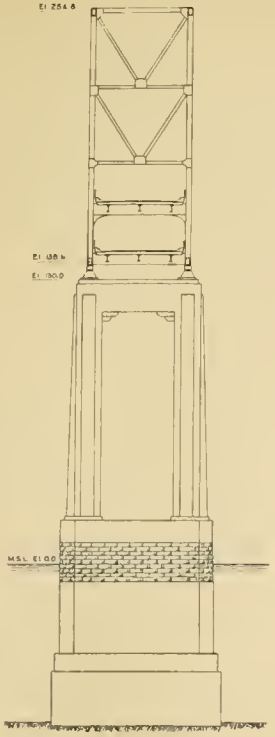
MYSTIC RIVER BRIDGE AUTHORITY

MYSTIC RIVER BRIDGE

BETWEEN BOSTON AND CHELSEA, MASS

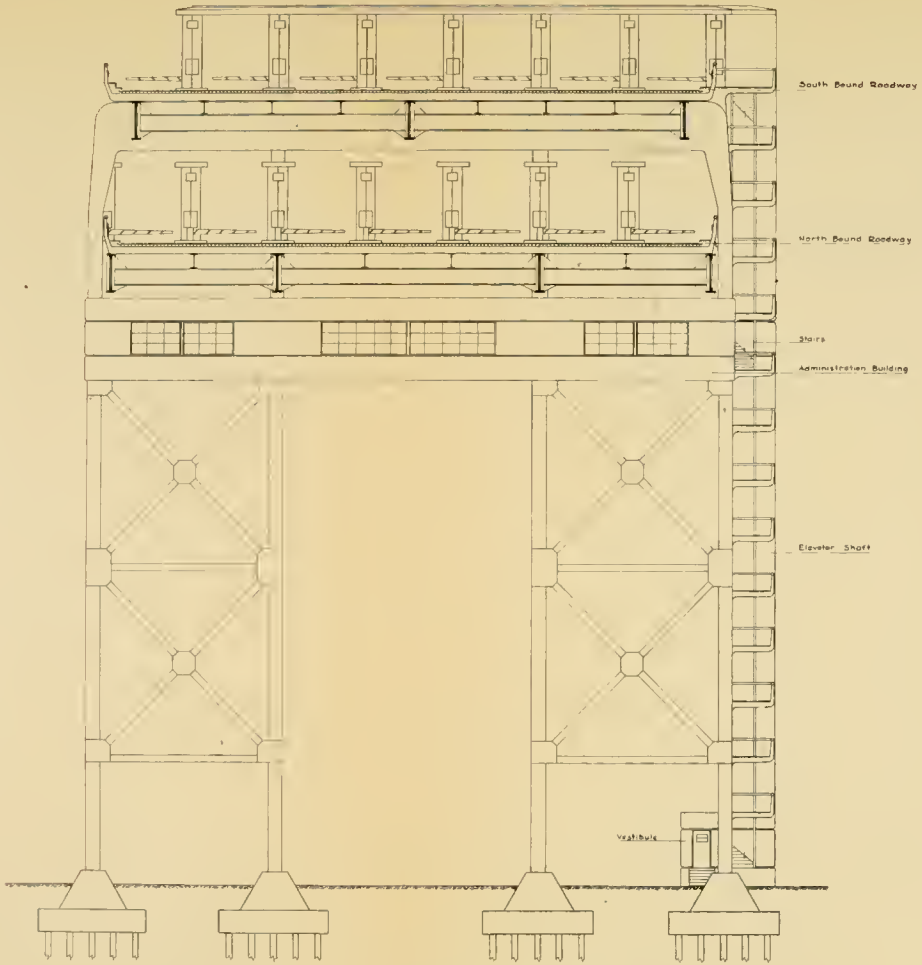
GENERAL LAYOUT

CHELSEA APPROACH



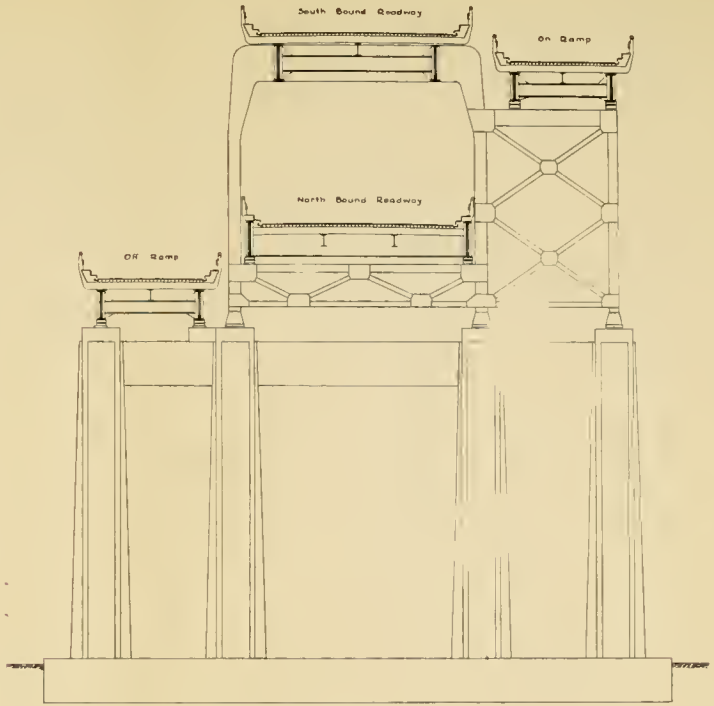
MAIN TRUSS
AND
RIVER PIER

10' 0 10' 20' 30' 40' 50' 60' 70' 80' 90' 100'



TOLL PLAZA AND ADMINISTRATION BUILDING

5' 0 5' 10' 15' 20' 25' 30' 35' 40'

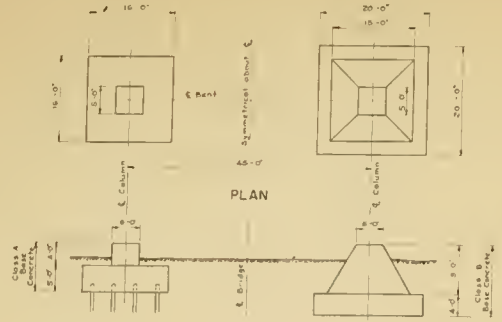


GIRDER SPANS ON ANCHOR PIERS

5' 0 5' 10' 15' 20' 25' 30' 35' 40'

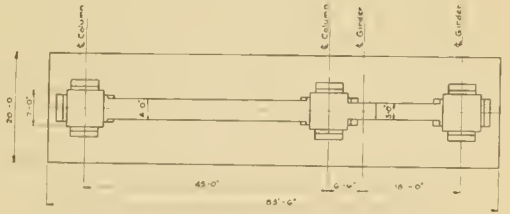
MYSTIC RIVER BRIDGE AUTHORITY
MYSTIC RIVER BRIDGE
BETWEEN BOSTON AND CHELSEA, MASS.

SPECIAL SECTIONS

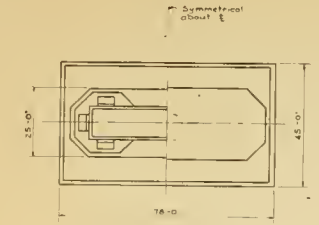


TYPICAL PEDESTAL ON PILES

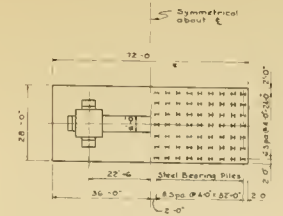
TYPICAL PEDESTAL ON SPREAD FOOTING



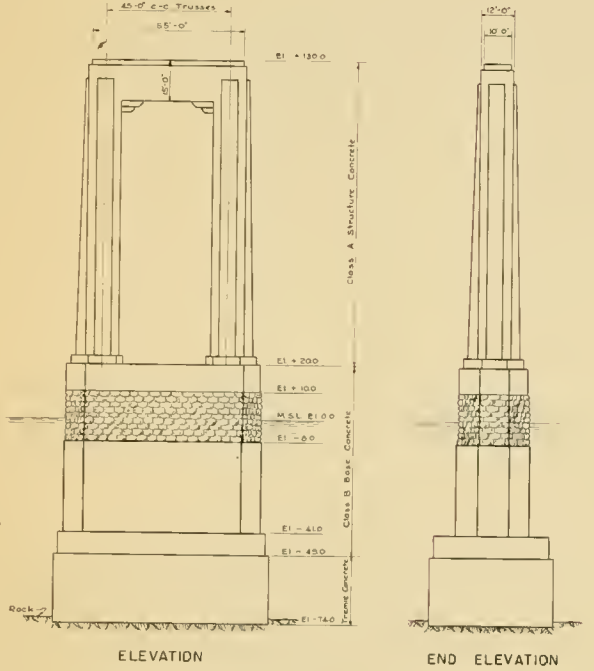
ANCHOR PIER - CHELSEA GIRDER SPANS



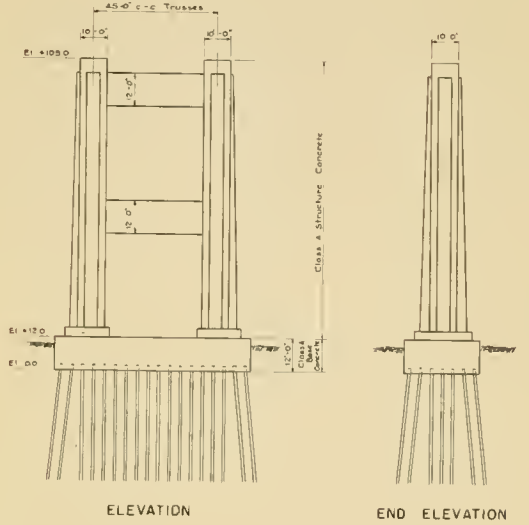
HALF PLAN HALF FOUNDATION



HALF PLAN HALF PILING PLAN



RIVER PIER



PIER 34

PIER 33 SIMILAR

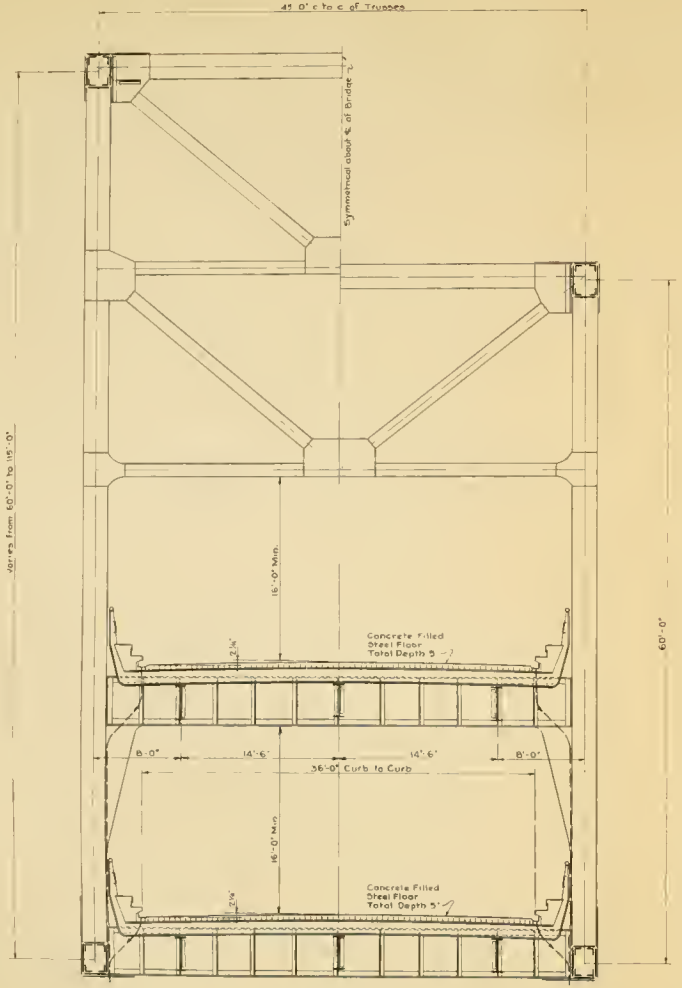
MYSTIC RIVER BRIDGE AUTHORITY

MYSTIC RIVER BRIDGE

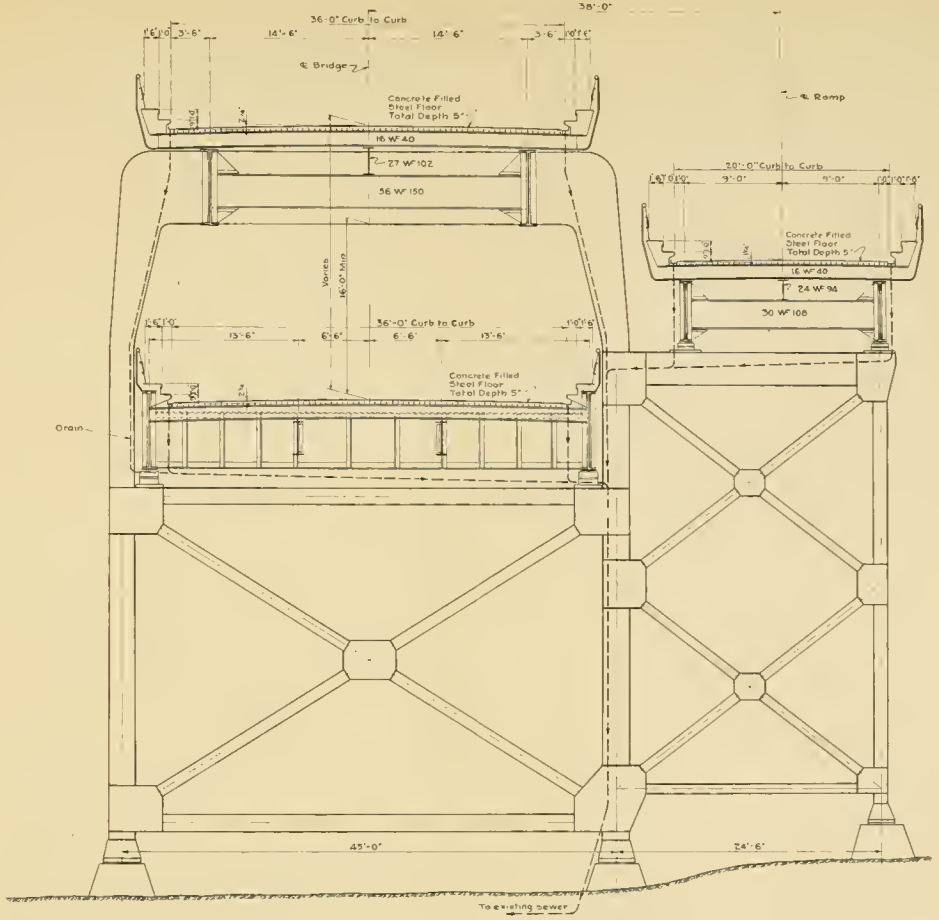
BETWEEN BOSTON AND CHELSEA, MASS.

SUBSTRUCTURE

PLATE 8



TRUSS SPANS



GIRDER SPANS

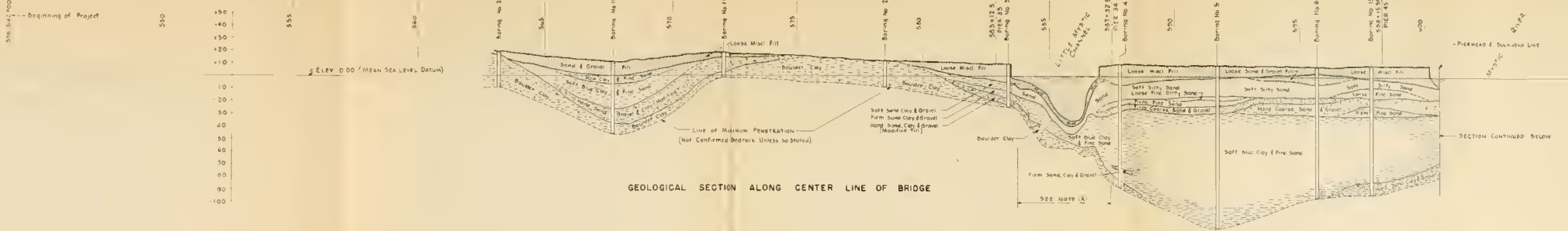
MYSTIC RIVER BRIDGE AUTHORITY

MYSTIC RIVER BRIDGE

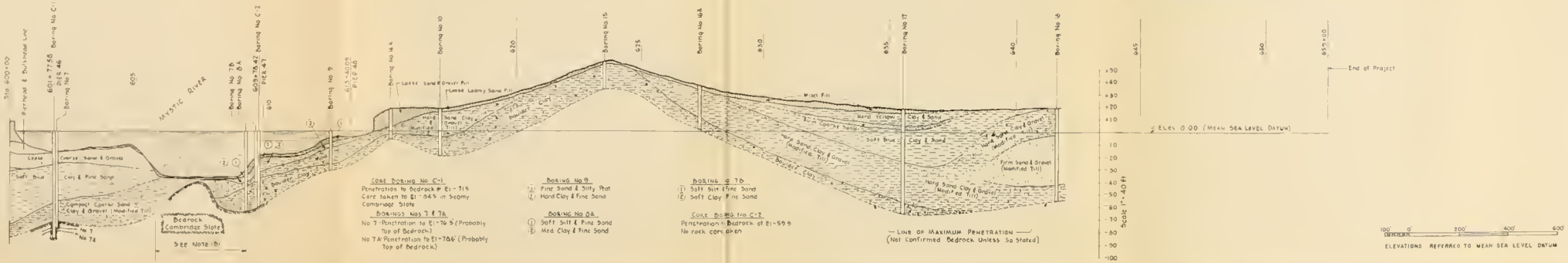
BETWEEN BOSTON AND CHELSEA, MASS.

SUPERSTRUCTURE TYPICAL SECTIONS

PLATE 9



GEOLOGICAL SECTION ALONG CENTER LINE OF BRIDGE



CORE BORING No C-1
Penetration to Bedrock at El - 71.5
Core taken to El - 84.5 in Swamp
Cambridge Slate

BORINGS Nos 7 & 7A
No 7 - Penetration to El - 76.5 (Probably Top of Bedrock)
No 7A - Penetration to El - 76.6 (Probably Top of Bedrock)

BORING No 9
(1) Fine Sand & Silty Peat
(2) Hard Clay & Fine Sand

BORING No 9A
(1) Soft Silt & Fine Sand
(2) Med Clay & Fine Sand

BORING No 7B
(1) Soft Silt & Fine Sand
(2) Soft Clay & Fine Sand

CORE BORING No C-2
Penetration to Bedrock at El - 59.9
No rock core taken

Line of Maximum Penetration
(Not Confirmed Bedrock Unless So Stated)

100' 0 200' 400' 600'
ELEVATIONS REFERRED TO MEAN SEA LEVEL DATUM

NOTES

(A) Length marked is composite section based on test borings made for Chelsea Bridge South in 1918 and 1919 plans dated March 29 1922
(B) Length marked is composite section based on
(1) Test borings for rebuilding of Chelsea Bridge North made in 1911 plans dated Jan 31 1912
(2) Test borings from plan "Proposed Tunnel Under Mystic River at Chelsea North Bridge" dated July 2 1900
3) Plan "Tunnel Under Mystic River at Chelsea Bridge North made by Metropolitan Water Works dated Jan 1902

GENERAL

1 All test borings shown are Gow Type (Raymond Concrete Pile Co) except No C-1 where rock core was taken. Standard Drive Test values for materials penetrated in all borings are on record Borings were made in March 1947

2 Heavy dashed line at bottom of section represents line of maximum penetration, not necessarily, top of bedrock unless so noted. Refusal in many cases may be due to boulders or dense boulder clay

3 Above bedrock sediments are either of glacial or recent alluvial origin (excepting made land). Bedrock is the Cambridge slate ranging from fine grained clay slate showing silty cleavage to massive coarse phase showing little or no cleavage.
Boulder Clay is an unsorted compacted glacial deposit or till composed of sand gravel clay rock flour and some scattered boulders, commonly termed "hardpan"
Modified Till is boulder clay somewhat modified by weathering, erosion, stream action etc. Finer materials are generally lacking, otherwise composition is similar to boulder clay but not as compact

MYSTIC RIVER BRIDGE AUTHORITY
MYSTIC RIVER BRIDGE
BETWEEN BOSTON AND CHELSEA, MASS.
GEOLOGICAL STUDY

MYSTIC RIVER BRIDGE
PROGRESS CHART